



True Mirror

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TOOLS:

- [Drill and bits \(1\)](#)
- [Glass cutter \(1\)](#)
if needed
- [Saw \(1\)](#)
- [Screwdriver \(1\)](#)
- [Straightedge \(1\)](#)
- [Work gloves \(1\)](#)



PARTS:

- [Mirrors \(2\)](#)
Must not be beveled. For best results, use front- surfaced mirrors (aka first surface mirrors) such as those at surplussshed.com.
- [Plywood \(1\)](#)
- [Wooden strips \(2\)](#)
- [Wood screws \(14\)](#)
- [Scrap wood \(1\)](#)
for wedges
- [Construction paper \(2 sheets\)](#)
- [Epoxy glue \(1\)](#)
- [Plywood or plastic \(optional\) \(1\)](#)
for an enclosure

SUMMARY

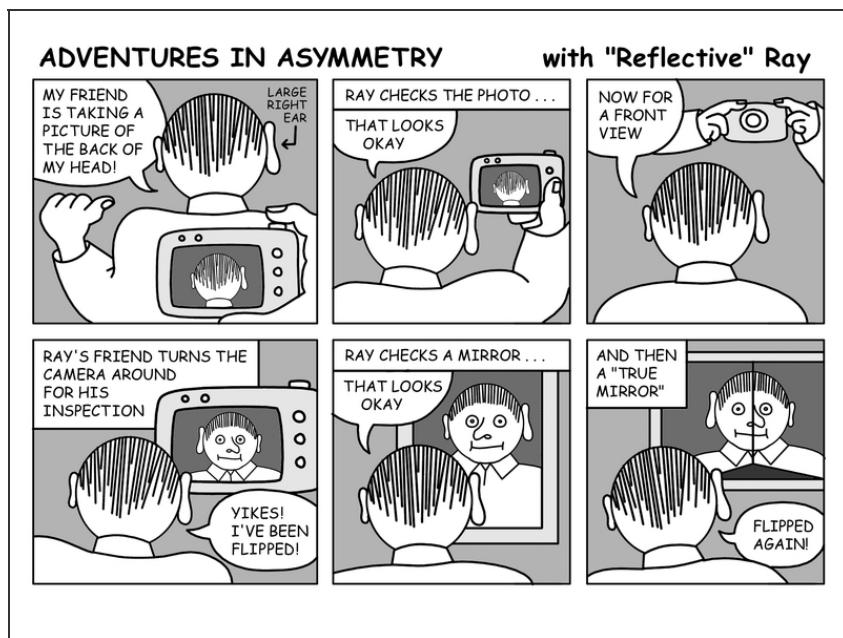
Most people believe that a mirror rotates your image from left to right, but this is not really correct. To clarify this confusing issue, I've sketched the story of an intrepid investigator named Ray, who reflects on it in some depth. Ray happens to have a right ear that's bigger

than his left, which makes it easy to see whether his image has been flipped. The lesson from this story is that when a photograph is turned around from the position in which it was taken, the image turns with it. Therefore, whether it looks as if your face is flipped depends on your point of view.

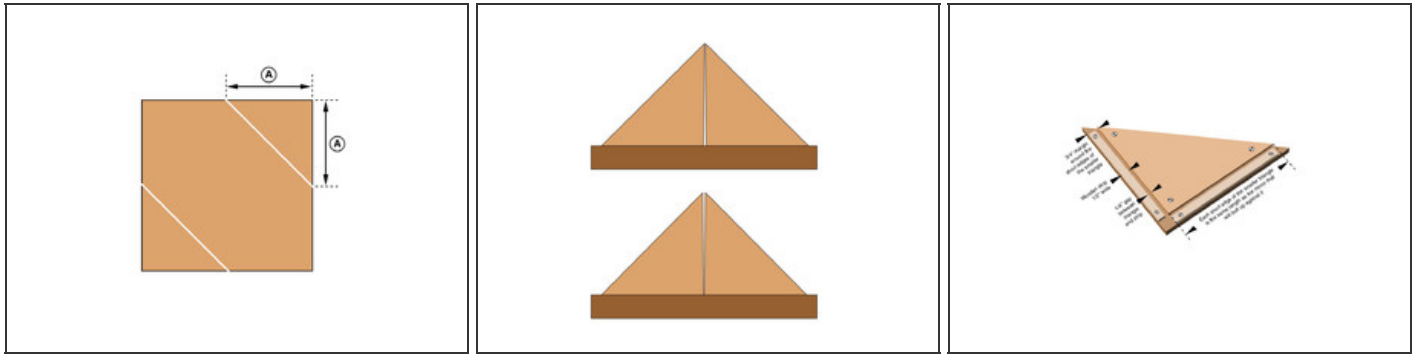
Can we create a mirror image that looks the same as a photographic image, so you see yourself as others see you? Two mirrors oriented at 90° to each other can produce this effect. Light from your face bounces off the first mirror and then the second mirror, rotating a total of 180° before it returns to your eyes. This combination of mirrors is often known as a “true mirror,” although I think of it as an “untrue mirror” because of the rotation that occurs.

Whatever you choose to call it, building it is easy enough. You just need a pair of small, rectangular, unframed mirrors, some plywood, and enough glue and screws to hold everything together. The only challenge is to mount the mirrors very precisely.

Step 1 — Choose your mirror.

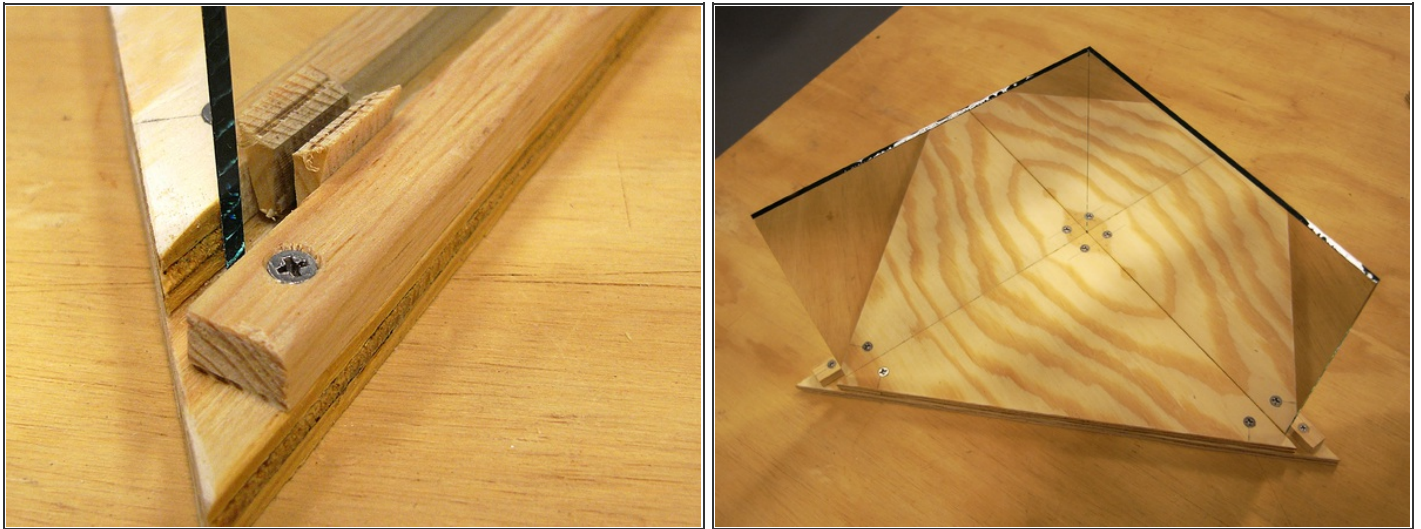


- The best kind of mirror for this project is one with its reflective surface on the front rather than the back. This will almost eliminate the visible gap between the reflections where the mirrors meet. Ordinary back-surfaced mirrors will work and save you money, but the reflected image will have a line down the middle.
- Whichever kind of mirror you choose, you should wear work gloves while handling it. Eye protection is also advisable. Don't underestimate the danger of broken glass, which has scalpel-sharp edges.
- The size of the mirrors is up to you, although if they measure less than 6"×6", your field of view will be limited. Some options are suggested in the parts list.

Step 2 — Create the mirror frame.

- After choosing your mirrors, you need 2 wooden triangles that contain exact 90° angles. One way to obtain them is to buy a precut 24"×24" square of 1/2" plywood from a hardware store, and remove 2 corners with a saw. Each short edge of each triangle should be the same length as the mirror that will be butting up against it.
- Check that the triangles are accurate by standing them opposite each other on a flat surface, with their vertical edges touching. If there is the slightest gap at the top or bottom, one or both of their angles isn't exactly 90° .
- Now cut 2 larger 90° triangles from your same square of plywood, with their short edges 1 1/2" longer than the short edges of the first 2 triangles. Screw each small triangle flat onto a large triangle, with the long edges flush and a 3/4" margin around the short edges. Add two 1/2"-wide wooden strips, leaving a 1/4" gap.

Step 3



- Stand your mirrors vertically in the gaps, and insert 2 small wedges behind each mirror to squeeze it firmly against the smaller triangle. Verify that the mirrors are precisely oriented, then mix some quick-setting epoxy, dribble it in behind the mirrors and around the wedges, and leave it to harden for at least an hour.
- Turn everything upside down, lower the mirror assembly into the gaps in the second set of triangles, and use glue and wedges as before. Your mirrors are now held securely between pieces of plywood above and below.
- Be careful not to touch the reflective surfaces during these procedures, because front-surfaced mirrors cannot be cleaned easily. To remove fingerprints, use Windex with an extremely light and gentle touch.



Step 4 — Finish and test.



- Your true mirror will look nicer if you cover the interior plywood surfaces. I used some thin black felt that I happened to have, although construction paper would be just as good. I then mounted the mirrors in an enclosure, not just to protect them, but to protect people from the glass edges.
- Your design for a box is up to you. Personally I chose ABS plastic, because it's so easy to work with (see [ABS Plastic Fantastic Desk Set](#)).
- The second picture shows some tests that you can perform, but here's the most important one. First, hold your true mirror facing you, with the joint between the mirror panels vertical. Check your reflection.
- Now keep the box facing you while you slowly rotate it till the joint between the mirrors is horizontal. You'll find that your image has turned upside down. Did you doubt me when I told you that a regular mirror doesn't rotate your image, but a true mirror does? Here you see the proof.

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